8 Environmental Risk and Preparedness Assessment

8.1 Summary of Environment and Emergency Risk

In preparation for drilling operation, an environmental risk assessment (ERA) (DNV Report 18869) and oil spill contingency analysis has been done to identify potential environmental risks and the implementation of risk reducing measures. As basis for this ERA, oil-drift modeling of an uncontrolled flow of formation fluids at surface was done. An uncontrolled flow is estimated to cause an oil spill with a weighted rate at 426 Sm^3 oil per day. The Ula-type oil has been selected as representative oil type. The oil-drift estimates have been performed covering five different durations, with the most extensive being 40 days, which is the time considered necessary in order to drill a relief well.

Further, an oil spill contingency gap-analysis has been performed for the well, to check if there are sufficient regional oil spill contingency resources available in case of a blowout (DNV Report 2007-0037). The analysis has been conducted according to NOFO's standard procedures. The proposed well belongs to NOFO's region 2D, where the installation Ula is the dimensioning activity with respect to oil spill contingency.

Due to a longer expected duration of the blowout, the activity did not directly pass the criteria of the gap-analysis, thus further calculations on the resources needed to combat oil at sea, as well as stranded oil, were therefore performed.

The worst-case blowout scenario for Oselvar is about 850 Sm^3 oil per day. Based on the characteristics of the Ula oil aged 24 hours, average emulsion volumes of about 1600 Sm^3 per day (summer) and 1400 Sm^3 per day (winter) have been calculated to be available for uptake at sea. Oil drift statistics show that about 16 % of the scenarios involve stranding of oil. Stranding probability is higher in winter (22 %) than in summer (10 %). The shortest calculated stranding times are longer and the volumes of stranded oil are smaller for Oselvar than for Ula. In conclusion, the existing regional oil-spill contingency preparedness in NOFOs region 2 is considered sufficient for drilling the well.

8.2 Oil Spill Contingency Analysis

An oil spill contingency analysis was conducted to determine the release rates of hydrocarbons in the event of an uncontrolled flow from the well and identify the necessary contingency plans that must be implemented prior to drilling the well.

Based on the analysis it was determined that the weighted average open hole blowout rate was

426 Sm^3 oil per day and the worst case open hole blowout rate was 830 Sm^3 per day, which corresponds to an average emulsion volume of approximately 1500 Sm^3 per day for uptake from the sea. The uptake efficiency in the period is calculated to be conservative at 50%.

Based on oil drift modeling there is a <5% probability of the oil spill influencing the coastline and about a 16% chance of stranding of oil. The oil drift modeling does not show the extension of the oil slick after a spill, however depending on the time of year can be extensive.

In conclusion, the existing regional oil spill contingency preparedness in region 2 of the NOFO system is considered sufficient for drilling the well.

8.3 Oil Spill Contingency Plan

An oil spill contingency plan specific for the well is currently prepared based on the oil spill contingency analysis for the well. The oil spill contingency plan is based on the NOFO master plan, which describes the necessary resources for an oil spill scenario on the Norwegian coast. The NOFO master plan assumes resources in this area capable of handling an emulsion rate of 3600 Sm^3 per day, while theoretical calculations for the well show an average well deliverability rate of 1500 Sm^3 per day.

In summary, the Oil Spill Contingency Plan for the well is as follows.

- Notification of an oil spill to the authorities shall be immediate.
- NOFO will be mobilized in the area within 12 hours.
- SLAR/IR/UV and IR camera and FLIR down-link will be mobilised within 18 hours to provided monitoring of the operations in darkness.
- Real-time oil spill modeling will be initiated immediately following an oil spill.
- Field investigation for monitoring the water column will be mobilised with 24 hours of an oil spill.

8.4 Environment Risk Assessment - Operation Discharges

Based on the assessment in Section 4 of the Application for Discharge Permit submitted to the Norwegian Pollution Control Authority on 5th March 2007, the environmental impact from the drilling activity is regarded as minimal and that there will be no damage to the environment while drilling the well in accordance with the planned measures described in the Application for Discharge Permit.

Based on the drilling programme a total of approximately 914 tonnes yellow and 36 tonnes red chemicals will be used in the water and oil based drilling fluid. The percentage of yellow and red chemicals that will be discharged is estimated to be 3,8% (35 tonnes) and 2,5% (0,9 tonnes), respectively. There is no planned use of black chemicals.

The classification and evaluation of the chemicals is based on the HOCNF data sheets provided by the chemical suppliers.

The drill cuttings and water base drilling fluids from the 36" top hole section will be discharge at the seafloor, whereas cuttings and water base drilling fluid from 24" and 17-1/2" top hole sections will be returned to the rig and discharged overboard. The cuttings from the 12-1/4" and 8-1/2" hole sections drilled with oil base fluid will be returned to the rig and transported onshore for treatment and disposal in a closed tank handling system. Verification of disposal and samples of the cuttings and fluid will be taken to ensure they meet acceptable standards for disposal.

There will be emissions to the atmosphere while drilling and testing of the well related to the energy usage on the rig and from the combustion of well test products. Emissions of CO_2 from the diesel engines on the rig are estimated at 2500 tonnes. The emission of CO_2 from the combustion of hydrocarbons is estimated at 3250 tonnes. In addition, it is anticipated that approximately 5 m^3 or 1% of the oil flared will fallout due to inefficiencies of the burning operations.

The discharge of oil water from the rig drainage and the engine room will be in a closed system to a dedicated container and taken onshore. When drilling using oil-base drilling fluid, drainage water from the drill floor and any accidental leakage from the mud pits will be collected in a closed system and processed and taken onshore. Any accidental leakages on the drill floor (e.g. hydraulic fluid) will also be contained via the closed system and taken ashore. There will be no discharge of impurified oily water to the sea (i.e. water with oil content >30 mg/litre).